SPECIFICATION

[Title of the Invention]

Sockets for module extension and the memory system using the sockets

[Brief Description of the Drawings]

The above objects and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. 1 shows a first example of conventional sockets loaded on a printed circuit board (PCB) and memory modules connected to the sockets;

FIG. 2 shows a second example of conventional sockets loaded on a PCB and memory modules connected to the sockets;

FIGS. 3A and 3B are sectional views of conventional sockets for loading memory modules used in the PCB;

FIG. 4 is a sectional view of a through socket according to a first embodiment of the present invention;

FIG. 5 is a sectional view of a through socket according to a second embodiment of the present invention;

FIG. 6 is a sectional view of a through socket according to a third embodiment of the present invention;

FIG. 7 is a sectional view of a turn around socket according to a first embodiment of the present invention;

FIG. 8 is a sectional view of a turn around socket according to a second embodiment of the present invention;

FIGS. 9A, 9B, and 9C show a first applied example of the first embodiment of the through socket and the first embodiment of the turn around socket, the electrical connection of the first applied example, and a three dimensional perspective of a real PCB, respectively;

FIGS. 10A and 10B show a second applied example of the first embodiment of the through socket and the first embodiment of the turn around socket and the electrical connection of the second applied example, respectively;

FIGS. 11A and 11B show a third applied example of the second embodiment of the through socket and the first embodiment of the turn around socket and the electrical connection of the third applied example, respectively;

FIGS. 12A and 12B show a fourth applied example of the first embodiment of two through sockets and the first embodiment of the turn around socket and the electrical connection of the fourth applied example, respectively;

FIGS. 13A and 13B show a fifth applied example of the first embodiment of two through sockets and the first embodiment of the turn around socket and the electrical connection of the fifth applied example, respectively;

FIGS. 14A and 14B show a sixth applied example of the second embodiment of two through sockets and the first embodiment of the turn around socket and the electrical connection of the sixth applied example, respectively;

FIG. 15A shows a seventh applied example of the second embodiment of the through socket, the third embodiment of the through socket and the second embodiment of the turn around socket; and

FIG. 15B shows the electrical connection of the seventh applied example.

[Detailed Description of the Invention]

[Object of the Invention]

[Technical Field of the Invention and Related Art prior to the Invention]

The present invention relates to a wiring connection apparatus of an electronic device, and more particularly, to a socket that occupies a small area of a printed circuit board (PCB) and lets a plurality of modules be easily extended and a memory system using the socket.

In the multimedia age, in which computer systems often require graphics of high quality, the integration density and speed of a semiconductor memory device must increase and the size of a semiconductor memory device must be reduced. A memory module changes corresponding to the changes in the semiconductor memory device. In particular, since a greater amount of memory than the amount used in conventional technology is required for real time processing of three dimensional data, a greater number of memory module boards must be loaded on a main board.

FIG. 1 shows a first example of conventional sockets loaded on a printed circuit board (PCB) and memory modules connected to the sockets.

Referring to FIG. 1, a PCB 10 includes two conventional sockets 11 and 12 installed to be parallel with each other and two conventional memory modules 13 and 14 loaded on the sockets 11 and 12.

The memory modules 13 and 14 connected to the two conventional

sockets 11 and 12 are connected to a central processing unit (not shown) in parallel through a plurality of data bus lines 15 and a plurality of signal lines 16. FIG. 2 shows a second example of conventional sockets loaded on a PCB and memory modules connected to the sockets.

Referring to FIG. 2, the PCB 10 includes two conventional sockets 11 and 12 installed to be parallel with each other on the PCB 10 and two memory modules 23 and 24 connected to the conventional sockets 11 and 12.

The memory modules 23 and 24 connected to the sockets 11 and 12 are serially connected to the CPU (not shown) through the plurality of data bus lines 15 and the plurality of signal lines 16.

As shown in FIG. 2, when the memory modules 23 and 24 are serially connected to the CPU through the plurality of data bus lines 15 and the plurality of signal lines 16, the memory modules 23 and 24 are formed so that data bus lines 15 and signal lines 16 running up along on one side can be connected to those running paths formed in the upper parts of the modules 23 and 24. One of the paths is indicated by a dotted circle.

FIGS. 3A and 3B are sectional views showing base sockets for loading memory modules used in a conventional PCB. FIG. 3A shows a base socket where the memory module is loaded parallel to the PCB. FIG. 3B shows a base socket where the memory module is loaded perpendicular to the PCB.

Referring to FIGS. 3A and 3B, the base sockets are attached to a PCB 34 by soldering socket fixing means 32 included in the base sockets.

The base sockets include socket pin fixing apparatuses 30a and 30b and two socket pins 33 for connecting the tabs of both surfaces of a memory module board 31. The two socket pins 33 pass through the insides of the socket pin fixing apparatuses 30a and 30b and are connected to corresponding printed circuit patterns (not shown) of the PCB 34.

Referring to FIGS. 1 through 3B, the number of memory modules used in a conventional system board is restricted by the number of sockets loaded on the system board, that is, the PCB, and installed so as to connect to the memory modules. When four sockets are loaded, the number of memory modules that can be loaded is restricted to four. The number of memory modules cannot be increased. When a user needs to use only two memory modules, the remaining two sockets are wasted.

Therefore, when a significantly large number of sockets for the memory modules are installed, the size of the PCB is large. When a small number of

sockets for the memory modules are installed, it is difficult to extend memory capacity.

[Technical Goal of the Invention]

To solve the above problems, it is an object of the present invention to provide a through socket and a turn around socket that are designed to extend a plurality of memory modules without increasing the size of a printed circuit board (PCB).

It is another object of the present invention to provide a memory system for extending a plurality of memory modules using the sockets.

[Structure and Operation of the Invention]

Accordingly, to achieve the first object, according to an aspect of the present invention, there is provided a socket for extending memory modules. The socket includes a socket pin fixing apparatus for loading two memory modules, that is, a first memory module and a second memory module, in opposite directions, a first socket pin for connecting a tab located on one surface of the first memory module to a tab located on one surface of the second memory module by passing through the socket pin fixing apparatus, and a second socket pin for connecting a tab located on the other surface of the first memory module to a tab located on the other surface of the second memory module by passing through the socket pin fixing apparatus.

According to another aspect of the present invention, there is provided a socket for extending memory modules. The socket includes a socket pin fixing apparatus for loading two memory modules, that is, a first memory module and a second memory module, in the same direction, a first socket pin for connecting a tab located on one surface of the first memory module to a tab located on one surface of the second memory module by passing through the socket pin fixing apparatus, and

a second socket pin for connecting a tab located the other surface of the first memory module to a tab located on the other surface of the second memory module by passing through the socket pin fixing apparatus.

According to another aspect of the present invention, there is provided a socket for extending memory modules. The socket includes a socket pin fixing apparatus for loading N (N is an integer and is greater than or equal to 3) memory modules, that is, a first memory module through an Nth memory

module, in the same direction, a first socket pin for connecting a tab of one surface of the first memory module to a tab of one surface of the Nth memory module by passing through the socket pin fixing apparatus, a second socket pin for connecting a tab of the other surface of the first memory module to a tab of one surface of a second memory module by passing through the socket pin fixing apparatus, and an Nth socket pin for connecting a tab of the other surface of the (N-1)th memory module to a tab of the other surface of the Nth memory module by passing through the socket pin fixing apparatus. Third through (N-1)th socket pins are formed by the same method as the connection method of the second socket pin.

According to another aspect of the present invention, there is provided a socket for extending memory modules. The socket includes a socket pin fixing apparatus for loading at least one memory module in the same direction, and at least one socket pin for electrically connecting the tabs of both surfaces of the memory module by passing through the socket pin fixing apparatus.

According to another aspect of the present invention, a socket pin fixing apparatus for loading two memory modules, that is, the first memory module and the second memory module, in the same direction and a socket for extending memory modules including the first socket pin and the second socket pin for connecting both side tabs of the first memory module and the second memory module by passing through the socket pin fixing apparatus.

To achieve the second object, there is provided a memory system. The memory system includes a plurality of memory modules, at least one through socket for electrically connecting the plurality of memory modules to each other, and a turn around socket for electrically connecting at least one surface of one of the plurality of memory modules to the other surface of the same memory module.

It is preferable that each of the plurality of memory modules comprises a plurality of memory devices loaded on both surfaces of each of the plurality of memory modules, and a total of four tabs that are located at both ends of both surfaces of each of the plurality of memory modules and operate as electrical paths.

It is also preferable that each of the at least one through socket comprises a socket pin fixing apparatus for loading two memory modules, that is, a first memory module and a second memory module, in opposite directions, a first socket pin for connecting a tab located on one surface of the first memory

module to a tab located on one surface of the second memory module by passing through the socket pin fixing apparatus, and a second socket pin for connecting a tab located on the other surface of the first memory module to a tab located on the other surface of the second memory module by passing through the socket pin fixing apparatus.

It is also preferable that each of the at least one through socket comprises a socket pin fixing apparatus for loading two memory modules, that is, a first memory module and a second memory module, in the same direction, a first socket pin for connecting a tab located on one surface of the first memory module to a tab located on one surface of the second memory module by passing through the socket pin fixing apparatus, and a second socket pin for connecting a tab located on the other surface of the first memory module to a tab located on the other surface of the second memory module by passing through the socket pin fixing apparatus.

It is also preferable that each of the at least one through socket comprises a socket pin fixing apparatus for loading N (N is an integer and is greater than or equal to 3) memory modules, that is, a first memory module through an Nth memory module, in the same direction, a first socket pin for connecting a tab of one surface of the first memory module to a tab of one surface of the Nth memory module by passing through the socket pin fixing apparatus, a second socket pin for connecting a tab of the other surface of the first memory module to a tab of one surface of a second memory module by passing through the socket pin fixing apparatus, and an Nth socket pin for connecting a tab of the other surface of the (N−1)th memory module to a tab of the other surface of the Nth memory module by passing through the socket pin fixing apparatus. Third through (N−1)th socket pins are formed by the same method as the connection method of the second socket pin.

It is also preferable that each of a selected number of at least one through socket comprises a first socket pin fixing apparatus for loading two memory modules, that is, a first memory module and a second memory module, in the same direction, a first socket pin for connecting a tab located on one surface of the first memory module to a tab located on one surface of the second memory module by passing through the socket pin fixing apparatus, and a second socket pin for connecting a tab located in the other surface of the first memory module to a tab located on the other surface of the second memory module by passing through the socket pin fixing apparatus. Each of the

remaining number of at least one through socket comprises a second socket pin fixing apparatus for loading three memory modules, that is, a third memory module, a fourth memory module, and a fifth memory module, in the same direction, a third socket pin for connecting a tab located on one surface of the third memory module to a tab located on one surface of the fifth memory module by passing through the second socket pin fixing apparatus, a fourth socket pin for connecting a tab located on the other surface of the third memory module to a tab located on one surface of the fourth memory module by passing through the second socket pin fixing apparatus, and a fifth socket pin for connecting a tab located on the other surface of the fourth memory module to a tab located on the other surface of the fifth memory module by passing through the second socket pin fixing apparatus.

It is also preferable that the turn around socket comprises a socket pin fixing apparatus for loading at least one memory module in the same direction, and at least one socket pin for electrically connecting tabs of both surfaces of the memory module by passing through the socket pin fixing apparatus.

Hereinafter, the present invention will be described in detail by explaining preferred embodiments of the invention with reference to the attached drawings. Like reference numerals in the drawings denote like elements.

FIG. 4 is a sectional view of a through socket according to a first embodiment of the present invention.

Referring to FIG. 4, the through socket includes a socket pin fixing apparatus 400 for loading a first memory module 41 and a second memory module 42 in opposite directions, a first socket pin 401 for electrically connecting a tab located on one surface of the first memory module 41 to a tab located on one surface of the second memory module 42 by passing through the socket pin fixing apparatus 400, and a second socket pin 402 for electrically connecting a tab located on the other surface of the first memory module 41 to a tab located on the other surface of the second memory module 42 by passing through the socket pin fixing apparatus 400.

FIG. 5 is a sectional view of a through socket according to a second embodiment of the present invention.

Referring to FIG. 5, the through socket includes a socket pin fixing apparatus 500 for loading a first memory module 51 and a second memory module 52 in the same direction, a first socket pin 501 for electrically connecting a tab located on one surface of the first memory module 51 to a tab located on

one surface of the second memory module 52 by passing through the socket pin fixing apparatus 500, and a second socket pin 502 for electrically connecting a tab located on the other surface of the first memory module 51 to a tab located on the other surface of the second memory module 52 by passing through the socket pin fixing apparatus 500.

FIG. 6 is a sectional view of a through socket according to a third embodiment of the present invention.

Referring to FIG. 6, the through socket includes a socket pin fixing apparatus 600 for loading a first memory module 61, a second memory module 62, and a third memory module 63 in the same direction, a first socket pin 601 for electrically connecting a tab located on one surface of the first memory module 61 to a tab located on one surface of the third memory module 63 by passing through the socket pin fixing apparatus 600, a second socket pin 602 for electrically connecting a tab located on the other surface of the first memory module 61 to a tab located on one surface of the second memory module 62 by passing through the socket pin fixing apparatus 600, and a third socket pin 603 for electrically connecting a tab located on the other surface of the second memory module 62 to a tab located on the other surface of the third memory module 63.

FIG. 7 is a sectional view of a turn around socket according to a first embodiment of the present invention.

Referring to FIG. 7, the turn around socket includes a socket pin fixing apparatus 700 for loading a memory module 71 and a first socket pin 701 for electrically connecting the tabs of both sides of the memory module 71 to each other by passing through the socket pin fixing apparatus 700.

FIG. 8 is a sectional view of a turn around socket according to a second embodiment of the present invention.

Referring to FIG. 8, the turn around socket includes a socket pin fixing apparatus 800 for loading a first memory module 81 and a second memory module 82 in the same direction, a first socket pin 801 for electrically connecting the tabs of both surfaces of the first memory module 81 by passing through the socket pin fixing apparatus 800, and a second socket pin 802 for electrically self-connecting the tabs of the both surfaces of the second memory modules 82 to each other by passing through the socket pin fixing apparatus 800.

FIG. 9A is a perspective view showing a first applied example of the first embodiment of the through socket and the first embodiment of the turn around

socket. FIG. 9B is a perspective view showing the electrical connection of the first applied example shown in FIG. 9A. FIG. 9C is a perspective view showing the first applied example on a printed circuit board (PCB).

Referring to FIG. 9A, in the first applied example, a first memory module 91 is loaded in a base socket 30a installed on a PCB 34. The first memory module 91 is connected to a second memory module 92 by a through socket 400. A turn around socket 700 is loaded on the upper portion of the second memory module 92.

Referring to FIG. 9B, in the first applied example shown in FIG. 9A, memory groups MG1 through MG4 are electrically and serially connected to each other in the following order: MG1, MG3, MG4, and MG2. An electrical connection in the reverse order is also possible. Here, the memory groups MG1 through MG4 refer to the set of a plurality of memories loaded on both surfaces of the memory modules.

Referring to FIG. 9C, a first memory module 91 is loaded in a base socket loaded on a PCB 10. The through socket 400 is installed between the first memory module 91 and the second memory module 92. The turn around socket 700 is loaded on the upper portion of the second memory module 92.

FIG. 10A shows a second applied example of the first embodiment of the through socket and the first embodiment of the turn around socket. FIG. 10B shows the electrical connection of the second applied example shown in FIG. 10A.

Referring to FIG. 10A, in the second applied example, the first memory module 91 is loaded in a base socket 30b installed on a PCB 34. The first memory module 91 is connected to the second memory module 92 by the through socket 400. The turn around socket 700 is loaded at one end of the second memory module 92.

Referring to FIG. 10B, in the first embodiment shown in FIG. 10A, the memory groups MG1 through MG4 are electrically and serially connected to each other in the following order: MG2, MG4, MG3, and MG1. An electrical connection in the reverse order is also possible.

FIG. 11A shows a third applied example of the second embodiment of the through socket and the first embodiment of the turn around socket. FIG. 11B shows electrical connection of the third applied example shown in FIG. 11A.

Referring to FIG. 11A, in the third applied example, the first memory module 91 is loaded in a base socket 30b installed on the PCB 34. The first

memory module 91 is connected to the second memory module 92 by a through socket 500. The turn around socket 700 is loaded at one end of the second memory module 92.

Referring to FIG. 11B, in the first embodiment shown in FIG. 11A, the memory groups MG1 through MG4 are electrically and serially connected to each other in the following order: MG1, MG4, MG3, and MG2. An electrical connection in the reverse order is also possible.

Referring to FIGS. 9A through 11B, the first through third applied examples disclose various methods for loading two memory modules on a PCB in a vertical direction, horizontal direction, and horizontal and vertical directions, respectively.

FIG. 12A shows a fourth applied example of the first embodiment of two through sockets and the first embodiment of the turn around socket. FIG. 12B shows the electrical connection of the fourth applied example shown in FIG. 12A.

Referring to FIG. 12A, in the fourth applied example, a first memory module 121 is loaded in the base socket 30a installed on the PCB 34. The first memory module 121 is connected to a second memory module 122 by a through socket 400-1, and the second memory module 122 is connected to a third memory module 123 by a connection socket 400-2. The turn around socket 700 is loaded at one end of the third memory module 123.

Referring to FIG. 12B, in the fourth applied example shown in FIG. 12A, memory groups MG5 through MG10 are electrically and serially connected in the following order: MG5, MG7, MG9, MG10, MG8, and MG6. An electrical connection in the reverse order is also possible.

FIG. 13A shows a fifth applied example of the first embodiment of two through sockets and the first embodiment of the turn around socket. FIG. 13B shows the electrical connection of the fifth applied example shown in FIG. 13A.

Referring to FIG. 13A, in the fifth applied example, the first memory module 121 is loaded in the base socket 30b installed on the PCB 34. The first memory module 121 is connected to the second memory module 122 by the through socket 400-1, and the second memory module 122 is connected to the third memory module 123 by the through socket 400-2. The turn around socket 700 is loaded at one end of the third memory module 123.

Referring to FIG. 13B, in the fifth applied example shown in FIG. 13A, memory groups MG5 through MG10 are electrically and serially connected in the following order: MG6, MG8, MG10, MG9, MG7, and MG5. An electrical

connection in the reverse order is also possible.

FIG. 14A shows a sixth applied example of the second embodiment of two through sockets and the first embodiment of the turn around socket. FIG. 14B shows the electrical connection of the sixth applied example shown in FIG. 14A.

Referring to FIG. 14A, in the sixth applied example, the first memory module 121 is loaded in the base socket 30b installed on the PCB 34. The first memory module 121 is connected to the second memory module 122 by a through socket 500-1, and the second memory module 122 is connected to the third memory module 123 by a through socket 500-2. The turn around socket 700 is loaded at one end of the third memory module 123.

Referring to FIG. 14B, in the sixth applied example shown in FIG. 14A, memory groups MG5 through MG10 are electrically and serially connected to each other in the following order: MG5, MG8, MG9, MG10, MG7, and MG6. An electrical connection in the reverse order is also possible.

Referring to FIGS. 12A through FIG. 14B, the fourth through sixth applied examples disclose various methods of loading three memory modules on the PCB in the vertical direction, the horizontal direction, and the horizontal and vertical directions, respectively.

As shown in FIGS. 12A and 12B, since the plurality of through sockets and memory modules are serially connected, it is possible to infinitely extend the memory modules.

FIG. 15A shows a seventh applied example of the second embodiment of the through socket, the third embodiment of the through socket, and the second embodiment of the turn around socket. FIG. 15B shows the electrical connection of the seventh applied example shown in FIG. 15A.

Referring to FIG. 15A, in the seventh applied example, a first memory module 151 is loaded in the base socket 30b installed on the PCB 34. The first memory module 151 is connected to a second memory module 152 by a through socket 200. The second memory module 152 is loaded in the upper stage of a through socket 600. A third memory module 153 is loaded in the middle stage of the through socket 600 and in the lower stage of the turn around socket 800. The fourth memory module 154 is loaded in the other stage of the turn around socket 800 and the upper stage of the third through socket 600.

Referring to FIG. 15B, in the seventh applied example shown in FIG.

15A, memory groups MG11 through MG18 are electrically and serially connected to each other in the following order: MG11, MG14, MG15, MG16, MG17, MG18, MG13, and MG12. An electrical connection in the reverse order is also possible.

While this invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

[Effect of the Invention]

When the through socket and the turn around socket according to the various embodiments of the present invention are used as mentioned above, as shown by the method of using the through socket and the turn around socket, it is possible to easily extend memory capacity desired by a memory system by efficiently and maximally using the available space on the PCB.